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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/735,824	12/16/2003	Hiroaki Takehara	032191	2855

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WASHINGTON, DC 20036

EXAMINER
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MCCRACKEN, DANIEL

ART UNIT	PAPER NUMBER
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1754

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/12/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

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<b>Office Action Summary</b>	<b>Application No.</b> 10/735,824	<b>Applicant(s)</b> TAKEHARA ET AL.	
	<b>Examiner</b> Daniel C. McCracken	<b>Art Unit</b> 1754	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-2 and 8-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2 and 8-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_.

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### DETAILED ACTION

Citation to patent literature will be in the form (Inventor #, LL) where # is the column number and LL is the line number. Citation to pre-grant publication literature will be in the form (Inventor PN, ¶) where PN is the page number and ¶ is the paragraph number.

#### *Response to Arguments*

Applicant's arguments, see "Remarks", filed 10/23/2006, with respect to the rejection of Claim 2 under 35 U.S.C. §112, ¶2 have been fully considered and are persuasive. The rejection of Claim 2 under 35 U.S.C. §112, ¶2 has been withdrawn.

Applicant's arguments with respect to claims 1-7 have been considered but are moot in view of the new ground(s) of rejection. Applicants' alleged points of novelty for the present invention, see "IV. Summary of Present Invention," Remarks of October 23, 2006, are known in the art and described in such a manner that one of ordinary skill in the art would combine their teachings. These alleged points of novelty are treated further in the rejections under 35 U.S.C. §103, *infra*. With respect to Applicants' discussion of the Alford reference, the remarks as to the purchase and incorporation of devices made by the corporation to which Mr. Alford belongs have been considered, but would appear to be secondary indicia of *obviousness* supporting a rejection under 35 U.S.C. §103.

Applicants made reference to a Japanese Office Action dated August 22, 2006 in their Information Disclosure Statement filed November 21, 2006. Such a document was not received by the Examiner and was accordingly not considered.

#### *Double Patenting*

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

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A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 1, 2, 8-12, and 14-16 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 10/735,844 in view of JP 06-056414 and in further view of McCabe, Smith and Harriot, *Unit Operations of Chemical Engineering*, pp. 195-197, 204-205 (5th ed., McGraw-Hill 1993). Claim 1 of 10/735,844 as amended on October 31, 2006 recites a method for producing fullerenes comprising: imperfect combustion of a hydrocarbon fuel, collection of the soot/fullerene combustion product via a filtering unit, and collecting the fullerenes from the soot/fullerene combustion product by regulating the temperature between the reactor and filtering unit in a range of between more than 300 and 600 °C via a water-cooling pipe and utilizing piping passage that "allow[s] the gas flow discharged from an exhaust port of the reactor to enter the piping passage in a direction tangential to the piping passage and to flow in a swirl inside the piping passage." Restated for completeness, Claim 1 of 10/735,844 recites a combustion process, a temperature-regulating unit to control the temperature of the combustion product to between 300 and 600 °C, and feeding the temperature regulated combustion product to a filtration process. As to the limitation regarding the gas in the piping passage flowing "in a direction tangential to the piping passage and [flowing] in a swirl inside the piping passage," it would appear as if Applicants are describing a centrifugal pump or fan (i.e. a vacuum pump). See McCabe et al. at 196 ("The liquid leaving the outer periphery of the impeller is collected in a spiral casing called the volute and leaves the pump through a tangential discharge connection.") See also McCabe et al. at 204 (applying the same principal to gases).

Claim 1 of the instant application differs from Claim 1 of 10/735,844 in that the instant application recites two filters, an inverted reactor with the burner at an upper portion and the exhaust port at a lower portion, and cooling the product from the second filter to 200 degrees or less.

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JP 06-056414 teaches a reactor for the production of fullerenes of the inverted type, where the fullerenes are produced at the upper portion of the reactor and discharged at the bottom. While JP 06-056414 discloses a plasma-generation system, a combustion system is an obvious expedient as both means are well known within the art. A person of ordinary skill in the art would be motivated to combine the teachings of JP 06-056414 with the Claim 1 of 10/735,844 because "deposition of the product in the [reactor] is reduced and the operation can continuously be continued [*sic*] over a long period." (JP 06-056414, Abstract).

With respect to the addition of a filter, "[i]t is well settled that the mere duplication of parts has no patentable significance unless a new and unexpected result is produced." *In re Harza*, 124 U.S.P.Q. 378, 380 (CCPA 1960). As to the cooling step for the gaseous effluent of the second filter, it would have been obvious to one of ordinary skill in the art to cool the polycyclic aromatic compounds ("PACs") to a temperature at which the PACs condense for purposes of collection, transportation, further treatment, etc.

As to Claim 2, Claim 1 of 10/735,844 discloses the same temperature range. As to Claim 8, Claim 11 of 10/735,844 discloses a filter member made of heat-resistant sintered metal. As to Claim 9, Claim 12 of 10/735,844 discloses the sintered metal being stainless steel. As to Claim 10-12, Claims 1 of 10/735,844 discloses a filtration apparatus. It would have been obvious to one of ordinary skill in the art to select a filter pore size to remove the desired impurity or end product. As to Claims 14, Claim 15 of 10/735,844 discloses the same pressure range. As to Claim 15 & 16, Claim 16 of 10/735,844 discloses the same range.

This is a provisional obviousness-type double patenting rejection.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Applicants have called attention to two alleged points of novelty in the claimed method. See "IV. Summary of Present Invention," Remarks of October 23, 2006, pp. 10-11 (describing "Point A" and "Point B"). As to the first *Graham v. John Deere Co.* inquiry, ascertaining the scope and contents of the prior art, the Examiner makes the following findings of fact: Applicants first alleged point of novelty, "Point A," deals with lowering the temperature of a gas stream containing fullerenes and polycyclic aromatic hydrocarbons<sup>1</sup> so as to condense the PAC before separating the PAC from the fullerenes with a filter. US 2004/0057896 A1 to Kronholm, et al. describes a condensation and separation scheme in detail. See (Kronholm 5, [0056] - [0058]) (Describing a condensation zone that controls conditions such as temperature to condense fullerenes. Paragraph [0058] explicitly states that "[o]ne or more collection steps may be employed in the separation of suspended solids from effluent gas." US 5,304,366 to Lorents, et al., as well as WO 93/13014 to Lorents, et al. describes the same condensation and separation scheme. US 5,304,366 discloses the creation of a temperature gradient (i.e. decreasing the temperature) across a series of filters such that "[larger] fullerenes will condense on the walls of the filter chamber [42] adjacent the top thereof, while [smaller] fullerenes will condense on the walls of chamber [42] adjacent the bottom thereof." (Lorents 5, 23-33). See also (Lorents 4, 43 *et seq.*) (describing the temperature/filter separation technique in greater detail) and (WO 93/13014, pp 8-11) (describing same). Thus, Lorents is illustrative of a generally recognized principle that larger compounds will vaporize at higher temperatures and

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<sup>1</sup> Claim 1 of the instant application recites "polycyclic aromatic compounds," while Applicants remarks recite "polycyclic aromatic hydrocarbons." For purposes of this Office Action, the two terms are treated as interchangeable. Reference hereinafter will be to polycyclic aromatic compounds or "PAC," which is consistent with the claim language.

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discloses a separation scheme that utilizes filters and heaters in such a manner that takes advantage of this principle.

Applicants second alleged point of novelty, "Point B," deals with the use of an "inverted reactor," namely one with a burner at an upper portion of the reactor and an exhaust port at the lower portion of the reactor. This reactor arrangement is disclosed in JP 06-056414 to Katsuhide, et al. JP 06-056414 discloses the advantages of utilizing such an arrangement, stating "the sooty product containing the produced fullerene compound is effectively dropped [into the product recovery/purification zone]. See JP 06-056414, Abstract. Further, this arrangement yields a "recovery rate of the fullerene compound [that] is extremely high." *Id.* The same inverted reactor principle is disclosed in US 6,887,291 to Alford, et al. in conjunction with a filter system. See (Alford 10, 16-18) ("This is especially useful for horizontal or *down-flowing synthesis methods*, as gravity assists the product into the receptor or collector.") (emphasis added). Thus, there is a recognized advantage in the art to utilize an "inverted reactor," namely harnessing the power of gravity to assist the flow of fullerene containing gases out of the reactor towards further processing steps.

Claims 1-2 and 8-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 2004/0057896 A1 to Kronholm et al. in view of JP 06-056414.

As to Claims 1 and 2, Kronholm et al. discloses the following: a combustion step (Kronholm 4, [0046]), a filtration step to remove soot (Kronholm 4-5, [0049]-[0051]), controlling the temperature in the separation zone in the claimed range such that fullerenes may be condensed and collected by further filtration (Kronholm 5, [0056] - [0060]) (Paragraph [0059] discusses separation from PAH (or PAC) explicitly.), and a vacuum pump (Kronholm 6, [0067]).

Kronholm does not teach an inverted reactor. JP 06-056414 describes an inverted reactor, as well as the motivation to use such a configuration, namely drawing the product down towards further processing which enables continuous operation.

As to Claims 8-9, Kronholm discloses a metal mesh filter. (Kronholm 6, [0066]). While Kronholm does not explicitly disclose sintered metal or stainless steel, it would have been obvious to one

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of ordinary skill in the art to use such a material so as to decrease reactions between the feed/product streams and the process equipment.

As to Claims 10-12, Kronholm discloses particles ranging in size from 0.1  $\mu\text{m}$  to 500 $\mu\text{m}$  being removed via filtration, which would necessarily flow from using the filter pore sizes claimed.

As to Claim 13, Kronholm discloses a range of 300°C to about 2000°C. (Kronholm 5, [0053]). As to Claims 14-16, Kronholm discloses a range of 10-200 torr. (Kronholm 11, [0106]). As to Claim 17, Kronholm discloses a separation temperature range of 300°C to about 2000°C. (Kronholm 5, [0053]). A range within a range is prima facie obvious. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

As to Claim 18, Kronholm discloses selecting a temperature to condense fullerenes of a desired volatility. (Kronholm 6, [0067]). “[D]iscovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art.” *In re Boesch*, 205 USPQ 215, 219 (CCPA 1980) (citations omitted).

As to Claims 19-21, Kronholm teaches that “[i]t is known in flame processes that fullerene concentrations, soot growth, and PAH concentrations depend on temperature and residence time in the flame,” and that “residence time and gas temperature in the transfer zone are factors to control when providing conditions that make the separations process efficient.” (Kronholm 4, [0047]). It would have been obvious to one of ordinary skill in the art to optimize the variables disclosed by Kronholm to arrive at the stream compositions claimed. *See In re Boesch*, 205 USPQ at 219.

Claims 1-2 and 8-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 2004/0057896 to Kronholm et al. as applied to claims 1-2 and 8-21 above, in view of US 6,887,291 to Alford, and further in view of US 5,304,366 to Lorents et al.

The preceding discussion of Kronholm is incorporated herein. To the extent JP 06-056414 does not teach an inverted reactor (alleged novelty “Point B”), Alford does. *See* (Alford 10, 16-18). To the extent Alford does not teach temperature regulation of process streams to condense fullerenes, Kronholm does (Kronholm 5, [0056]), as does Lorents (Lorents 4, 43 *et seq.*).



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As noted in the previous Office Action, Figure 2 of Alford and Figure 1 of Applicants' application are near facsimiles of one another, the exception being Applicants have placed another filter in series and inverted their reactor. Multiple filters was expressly contemplated by Alford. *See* (Alford 3, 51-54) ("The filter device of this invention comprises *one or more gas-permeable filters* in fluid communication with a reactor for synthesis of carbon nanomaterials to receive product gas flow from the reactor.") (emphasis added). To the extent a skilled artisan would not have inverted a reactor on his own, Alford suggests that it may be beneficial to do so. (Alford 10, 16-18).

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel C. McCracken whose telephone number is (571) 272-6537. The examiner can normally be reached on Monday through Friday, 9 AM - 5 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley S. Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

  
Daniel C. McCracken

DCM

  
**STUART L. HENDRICKSON  
PRIMARY EXAMINER**